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A N
E S S A Y
UPON THE
A M E N D M E N T
OF THE
C A L E N D A R.



D U B L I N :
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M D C C L V I .

A H

ESSAY

ON THE

AMENDMENT

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CALENDAR



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TO
Christopher Robinson, Esq.

AND TO

Doctor Robert Robinson.

GENTLEMEN,

THE Happiness which I enjoyed in a long and uninterrupted Friendship with your most learned and valuable Father, Dr. BRYAN ROBINSON, required some Testimony of it, how small soever, on my Side.

When the Design of reforming the *English* Calendar was made publick, I began to review my former Thoughts upon that Subject; intending,

intending, as soon as they were in Order, to present them to Him. His unfortunate Illness, which was followed by Death, put it out of my Power to accomplish that Intention.

But that it may not be disappointed; I desire You, the worthy Representatives of such a Father, to accept this ESSAY; not only as a Memorial of my Friendship with Him, but as a Pledge of its Continuance with Us who survive. For I am,

GENTLEMEN,

Your

most sincere Friend,

and most humble Servant,

Dublin, Oct.
20, 1755.

John Echlin.



A N

ESSAY, &c.

THE Design of altering the Stile of the Year, and of amending the Calendar, deserved great Applause, for the excellent Use of it both in Civil and Ecclesiastical Affairs.

It is very convenient to Commerce that the Year should begin at the same Time in all Nations, if that could be; but especially in *Europe*, where it may easily be done.

It is no less useful to the Husbandman, to have the Seasons return at the same Time of the Year.

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And for the Observation of *Easter* it is surely a Matter highly decent and becoming that the Feast of our Saviour's Resurrection should be celebrated on the same Day, in all Churches Reformed or Unreformed throughout all *Christendom*.

This Design had a peculiar Claim of Right to be considered and received in *England*, as the first Proposition that was ever made on this Subject, came from an *Englishman*.

Roger Bacon, an *Englishman*, and a *Franciscan* Fryar, flourished in the 13th Century, under *Henry* the third and *Edward* the first, and died A. D. 1284. His great Learning, which would have justly been esteemed in a learned Age, served only, in that Age of Ignorance, to produce an Accusation of Magic against him before his Patron *Clement* the 4th, by whom he was some-
time

time kept in Prison, and afterwards dismissed.

A Man who had penetrated into all Arts and Sciences, as *Vossius* says that *Bacon* had done, could not but observe the Spring *Æquinox* to have deserted the Seat assigned to it by the *Nicene* Fathers on the 21st of *March*, and in his Time fall earlier about seven Days.

He wrote thereupon an Epistle to *Clement* about the Reformation of the Calendar, shewing the Causes from whence the Variation between the Heavens and the Calendar arose.

Clement held the Pontifical Chair not four Years compleat, and died in the latter End of 1268, so that possibly this Epistle came too late to be considered in the Life-time of that Pope; or it might have been too subtile and refined for that Age; or perhaps the Pope might fear to

raise some new Controversy about *Easter*, all the old ones having been quieted for several Centuries.

But, whatever was the Cause, it is certain that the Proposal was neglected at that Time, and for above three Hundred Years after. When at last, Learning having raised her Head, and a Difference of ten Days in the Spring *Æquinox* between the Heavens and the Calendar became very observable, this Matter was taken into Consideration under Pope *Gregory* 13th, about the Year 1581, and the Correction of the Calendar took Place in the Year 1582.

Had any Attention been given to *Bacon's* Proposition, the Honour of that Correction should have been ascribed to *England*, as the Proposition came originally from thence; and a *British* Parliament, without incurring a Suspicion of being inclined

clined to *Popery*, might resume it at Pleasure.

It is not impossible that a Fear of that Kind might at first have prevented *England* and other Protestant Countries from receiving the New Stile; for, the Reformation of Religion preceding that of the Calendar not by many Years, if the reformed Churches had immediately received that Stile, it might have been construed by some weak People to be an Act of Submission to the Pope's Injunctions, and a Signal of returning to his Obedience. But if ever there was such a Fear, it is over long ago.

SECT.

S E C T. I.

THE Church of *England*, in Conformity to the Council of *Nice*, says, “ *Easter Day* is always the first *Sunday* after the first full Moon which happens next after the one and twentieth Day of *March*; and, if the full Moon happens on a *Sunday*, *Easter Day* is the *Sunday* after.”

When the Fathers were assembled at *Nice*, A. D. 325, the Spring *Æquinox* was accounted to fall on the 20th or 21st Day of *March*, for two Days must be allowed by Reason of the *Leap Year*, and the latter Day was chosen, lest *Easter* might happen before the *Æquinox*.

This Rule has Respect to the Time of the *Æquinox*, and to the Return of the new Moons, exactly
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in Point of Time, after a Period of 19 Years, which in that Age were thought to be invariable; but the Defects of the Rule were discovered, after some Centuries, in each of those Particulars.

The Anticipation of the *Æquinox* was not then known; and the *Julian* Year, consisting of 365 Days and 6 Hours, was taken to be the compleat Measure of the Year. But the Observations of after Ages, and a better Knowledge in Astronomy, have shewn it to be otherwise.

If the Earth departs from any cardinal Point, suppose the *Æquinox* of Spring, and from a fixed Star together, it will not arrive at both at the same Time; but the next Year it will come first to the *Æquinox*, and a little Arch of about 50" of a great Circle will remain to be described by the Earth, before it reaches the Star; and 20' of Time, with
some

some Seconds, are requisite for the Description of that little Arch.

The Interval of Time employed by the Earth in its Return to the same Star, is called the *Sidereal Year*, and consists of $365^d\ 6^h\ 9'$ and some Seconds.

The Interval of Time employed by the Earth in its Return to the same *Æquinox*, is called the *Tropical Year*, consisting of $365^d\ 5^h\ 49'$, more or less by a few Seconds; for Astronomers are not agreed upon the just Measure of it. The Return of Seasons depends upon the *Tropical Year*; it is therefore very convenient to have the Times of their Return fixed as nearly as may be, to certain Days.

The *Julian Year* is so called from its Author, *Julius Cæsar*, who by his Power, as Dictator, instituted it 46 Years before the Christian *Æra* began. He appointed the
Year

Year to consist of $365^d\ 6^h$. Those six Hours collected four Times, make a Day ; and therefore he ordered a Day to be intercalated, or inserted every fourth Year, between the 23d and 24th of *February* ; so that three Years consisted each of 365, and the fourth of 366 Days, which last is called *Bissextile*, because the sixth of the *Calends* of *March* is twice reckoned.

The *Julian* Year is nearly of a mean Length between the *Sidereal* and *Tropical*, being exceeded by the *Sidereal* about nine Minutes, and exceeding the *Tropical* about eleven Minutes of Time.

It is justly to be admired that in such an early Age a Form of the Year should be contrived so near the true one, yet so simple and so well adapted to Astronomical Uses, that it will for ever be retained, with some small Allowance for its Excess
above

above the *Tropical* Year ; and therefore, notwithstanding any such Allowance, it ought to keep the Name of *Julian*, in Honour to its Author, who by one Act of correcting the Calendar in a Manner so useful to Mankind, is intitled to more real Honour than by all his Victories and Triumphs.

The *Tropical* Year being shorter than the *Julian*, the Difference, whatever it is, will occasion the *Æquinox* of the next Year to fall so much earlier ; in the second Year that Difference will be doubled ; and so on till the Sum of those Differences amount to a Day.

The *Nicene* Synod fixed the Spring *Æquinox* to the 21st of *March*, by which the Latitude of a Day is allowed ; and therefore till the Sum of those Differences amounted to a Day, there was not any Variation from their Rule. Try then
in

in what Time the *Æquinox* will fall out earlier by a Day.

Suppose the *Tropical* Year to consist of $365^d 5^h 49' 12''$, the Excess in the *Julian* Year will be $10' 48''$, and consequently the *Æquinox* will fall earlier by a Day in $133\frac{1}{3}$ Years, that is by three Days in 400 Years. On this Supposition the *Gregorian* Amendment proceeds to omit three Days in that Period. Every *Centurial* Year in the *Julian* Account is *Bissextile*; it was ordered therefore, that three successive *Centurial* Years should be common, by omitting the Intercalation, and the fourth should be *Bissextile*; thus the Year 1600 was *Bissextile*, the Years 1700, 1800, 1900, are common, and the Year 2000 will be *Bissextile*, and so on continually.

But the Excess of the *Julian* Year seems to be a little greater. Mr. *Street*, in his *Caroline* Astronomy, makes

makes the Difference to be 10' 59", others make it yet greater.

At the Time of the *Nicene* Council the *Æquinox* fell upon the 21st or 20th of *March*; but in the Year 1600, at the Distance of about 1300 Years, it fell upon the 11th or 10th of *March*, and consequently had anticipated ten Days, or nearly at the Rate of one Day in 130 Years. That Proportion, if it were accurate, would make the Excess of the *Julian* Year to be 11' 5", as the learned Bishop *Beverige*, in his *Chronology*, has taken it to be.

Suppose then the annual Excess to be 11', that is greater than the first Supposition by 12". In a Period of 400 Years, those 12" amount to 80' Minutes; by which dividing 1440', the Number of Minutes in a Day, the Quotient is 18; so that in 18 Periods of 400, or in 7200 Years, the *Æquinox* will anticipate another

another Day. This Error is too inconsiderable to cause any Amendment of the first Supposition, which is so very simple and useful, and which keeps the *Æquinox* fixed to a certain Day for so long a Period.

The *Gregorian* Astronomers finding in the Year 1600 the *Æquinox* to have gone backward ten Days, cut off ten Days from the Calendar, so that the 11th of *March* came to be called the 21st of that Month. This Lopment of the Calendar was not at all necessary, but was purely out of Respect to the Decree of *Nice*, to keep the *Æquinox* at the same nominal Day, otherwise it might as well have been fixed to the 11th of *March*, on which it fell at the Time of correcting the Calendar.

The Omission of three Days in 400 Years will not cause any apparent Alteration in the Calendar, if it be considered without Respect to the

the old one ; but comparing them together, and supposing the old Calendar to be fixed, the new one will seem to ascend one Day in every *Centurial* Year that does not admit an Intercalation ; and consequently it will ascend three Days in 400 Years, and nine Days in 1200 Years.

But if the new Calendar stands fixed, as it ought to do, then the old one will seem to move downward with the same Difference as the other seemed to ascend.

Hence a Change will be made in the *Sunday* Letter ; for whenever the old Calendar descends one Day, it must carry down with it the *Sunday* Letter one Step, according to the Order of the Alphabet.

This Change of the *Sunday* Letter depends upon the Difference of Days accounted between the two Calendars, which Difference is increased

creased by Unity every *Centurial* Year that is not intercalated; and when that Difference is 7, or any Multiple of 7, the *Sunday* Letter will be the same in both Stiles.

S E C T. II.

THE other Article of the *Ni-*
cene Rule to determine *Easter* relates to the full Moon falling upon, or next after the Day of the Spring *Æquinox*.

Meto, an *Athenian* Astronomer, observed the new Moons to return on the same Day of the Month after a Period of nineteen Years; and concluded them to return at the same Minute of the Day accurately. On this Foundation the Golden Numbers were adjusted in the Calendar, to shew the new Moons, as it was then thought, for ever; but Time has discovered that Mistake.

The

The Motion of the Moon being subject to many Inequalities, the Periods between her Conjunctions with the Sun must be unequal ; it is therefore necessary to take a middle Rate of Time between her real Conjunctions, which shall be always equal ; and this is called the Period of her mean Conjunctions ; whence the true Conjunction will rarely coincide with the mean, but sometimes precede, and sometimes follow it, with a Difference of several Hours, but not of an intire Day.

The *Nicene* Rule allows a Day for the full Moon, and therefore Obedience may be paid to it, by assuming the mean instead of the true Lunations.

The mean Interval between two Conjunctions of the Moon and Sun is generally held to be $29^d\ 12^h\ 44'\ 3''$, and in a *Calippic* Period, consisting of four *Lunar* Cycles, or 76 Years,

Years, the mean Lunation will return upon the same Day, but earlier by $5^h 52' 13''$. By this Proportion the Moon will anticipate an intire Day in 310,7 Years.

But the *Gregorian* Astronomers have assumed the Anticipation of the Moon to be one Day in 312 Years and a Half, or eight Days in 2500 Years; and have distributed it in a Manner as conveniently as might be for common Use. They divide those 2500 Years into eight lesser Periods, and make the seven first of them to consist each of three Hundred Years, and the eighth to be of four Hundred Years, and suppose the Moon to anticipate one Day in each of the first seven Periods, and one in the last, consisting of four Hundred Years; so that there should be an Anticipation of eight Days in 25 Centuries.

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The

The new Moons falling earlier in certain Periods of Time, it is evident that the Golden Numbers in the Calendar should wait on their Motion, that the Days on which the new Moons fall may be rightly pointed out. By the above mentioned Analogy, in the Year 1600 the Moon had anticipated four intire Days since the Council of *Nice*, and consequently the Golden Numbers should have been placed four Days higher than they were at first. Thus, for Example, the Golden Number 5 stood originally at the 9th of *March*, and in 1600 it ought to have stood at the 5th of that Month, four Days higher. But by the nominal Suppression of ten Days, the 5th was called the 15th of *March*; so that in the Year 1600, the Number 5 should have stood in the new Calendar at the 15th of *March*, fix intire Days lower than it did in the old

old one. All the Golden Numbers are conceived to be affected in the same Manner ; thus the Number 3, which was placed at the first Day of *March*, should be found at the 7th Day of that Month.

But the learned *Cassini* complains, that in the Execution of the *Gregorian* Project, the Jesuit *Clavius* allowed but three Days for the Moon's Anticipation at that Time, by which Means the Difference of that Anticipation and the Number of Days suppressed was seven ; and the Number 3 was to descend from the first of *March* to the 8th Day of that Month in the Year 1600, and so of the rest.

Hence it appears that the Places of the Golden Numbers may be found at any given Time, by subtracting the Days anticipated by the Moon from the Difference of Days accrued between the two Calendars

in the same Time ; for the proper Motion of the Golden Numbers is to ascend as the Moon anticipates ; but the Number of Days suppressed descends in the new Calendar, and their Difference shews the Descent of the Golden Numbers at the Time required.

At the Amendment of the *Roman* Calendar, the Golden Numbers appointed by the Council of *Nice* were laid aside, and a Cycle of *Epaets* was instituted in their stead.

The very learned Reformer of the *English* Calendar retains the Golden Numbers so far as they answer the Design of that Council, and are useful to determine the Time of *Easter*. He gives them place only within the Limits of the *Paschal* full Moons, that is from the *March* 21st to *April* the 18th, both inclusive ; where now they do not shew the new
Moons

Moons as they did formerly, but the full Moons upon which *Easter* depends.

It is true, the Intention of finding *Easter* may be answered by either Method ; but if a religious Adherence to the *Nicene* Council were to be observed, as far as conveniently might be, certainly a much greater Respect is paid in *England* to that venerable Body, than there was at *Rome*.

The two main Points being determined, or rather assumed as nearly true, that the *Æquinox* anticipates three Days in 400 Years, and the Moon eight Days in 2500 Years, it will be easy to determine the Period wherein the Golden Numbers would descend a compleat Lunation ; and resume the Places which they had in the Beginning.

Call the Time of that Period P,
the Time of a Lunation L, then
P

$\frac{P \times 3}{400}$ will be the Number of Days anticipated by the *Æquinox*; $\frac{P \times 8}{2500}$ will be the Number of Days anticipated by the Moon in that Period; and the Difference of those two Numbers will be equal to a Lunation; that is $\frac{P \times 3}{400} - \frac{8}{2500} = \frac{P \times 43}{10000} = L = 29^d.53^o.59^2$ and $P = 6867.5$ Years. But the Period should consist of intire Centuries, and the nearest Number is 6900 Years, which is agreeable to the *English* Calendar, and is sufficiently accurate for Ecclesiastical Uses.

Hence a general Table may be made shewing, for every Century throughout the Period, the Anticipations of the Moon, the Difference of Days between the two Calendars, the Descents, Stations, or Ascents of the Golden Numbers, with the Differences between the *Julian* and new *Epacts*.

Table

Table I. consists of six Columns.

1. In the first Column are the Dominical Letters for each Centurial Year, which return in the same Order every 400 Years.

2. The second Column contains the Centurial Years from 1600 to 8400, both inclusive, which make up the Period of 6900 Years.

3. In the third, the Years on which the *Lunar* Anticipations take Place, are marked by a black Speck, with its Number over it.

4. The Numbers in the fourth Column shew the Differences of Days between the two Calendars, occasioned by omitting three Days in 400 Years, from the Year 1600, at which Year the present Period begins. But the Difference was already of ten Days at that Time ; and therefore those Numbers must be increased by 10, to have the true Difference at any Time.

5. The

5. The fifth Column is the same with that exhibited in the new *English* Calendar, Column 3d of the second general Table. The Numbers in it are the Differences between the collateral Numbers in the 3d and 4th Columns of this present Table ; that is, they are found by subtracting the *Lunar* Anticipations from the Difference of Days both occurred from the Year 1600, to any Century required. And they shew how many Places the Golden Numbers are to stand lower in the Calendar than they did in the Beginning of the Period, in the Year 1600.

And therefore, the Numbers in this Column may not improperly be called the *Characters* of those Centuries to which they belong.

6. The sixth Column contains the Differences between the *Julian* and new Epacts for those Centuries to which they are affixed ; and is formed

formed by the Addition of 10 to the Numbers in the fifth Column.

Had there been no Difference between the Epacts at the Beginning of the Period, the fifth Column would serve to shew the growing Difference of Epacts from that Time, as well as the Descent of the Golden Numbers ; but the *Gregorians* having made 10 to be the Epactic Difference in the Year 1600, there must be added 10 to the Numbers in the fifth Column to have the true Difference, which subtracted from the *Julian* Epact, (augmented by 30, if need be) leaves the new Epact for any Year proposed within the Century or Centuries to which that Difference is affixed.

S E C T.

SECT. III. Of *Easter*.

THE Feast of the *Passover* was instituted by God himself, when he smote the first born in *Egypt*, and passed over the *Israelites*, whose Houses were marked with the Blood of the Lamb, that was slain on this Occasion.

The whole Ceremony is appointed in the 12th Chap. of *Exodus*.

The Lamb, or Kid, was to be killed on the 14th Day of the first Month. The Beginning of the Year was now altered, and the first Month began with that new Moon the fourteenth Day whereof fell upon, or immediately after the Spring *Æquinox*.

The new Moon was accounted from the Appearance of it, and that generally was upon the second Day, so that the full Moon was reckoned
on

on the 14th Day. This Feast, with the Ceremonies there prescribed, was to be observed in their Generations for ever, as a Memorial of that great Deliverance when God brought the Armies of *Israel* out of *Egypt*.

It is very likely that on the *Egyptian* Side too, there might have been a Memorial instituted of the Horrors and Destruction of that Night. It has always seemed highly probable to me, that the *Λυχνόαια*, or *burning of Lamps* at *Sais*, mentioned by *Herodotus*, was intended for that Purpose, as it is so peculiarly adapted, not only to preserve the Memory, but to guard, if they might possibly, against the Return of such a dreadful Night.

The Account in *Exodus* compared with the Passage in *Herodotus*, will shew the Agreement between them.

The

The Scripture delivers it thus*.

“ And *Moses* said, Thus saith the
 “ Lord, about Midnight I will go
 “ out into the Midst of *Egypt*, and
 “ all the first born in the Land of
 “ *Egypt* shall die, from the first
 “ born of *Pharaoh*, that sitteth on
 “ his Throne, even unto the first
 “ born of the Maid-servant that is
 “ behind the Mill, and all the first
 “ born of Beasts. And there shall
 “ be a great Cry throughout all the
 “ Land of *Egypt*, such as there was
 “ none like it, nor shall be like it
 “ any more.

And we read this Menace to have
 been fully executed. “ And it came
 “ to pass that at Midnight the Lord
 “ smote all the first born in the
 “ Land of *Egypt*, from the first
 “ born of *Pharaoh*, that sat on his
 “ Throne, unto the first born of the
 “ Captive

* *Exod.* xi, 4, 5, 6.

“ Captive that was in the Dungeon,
“ and all the first born of Cattle.

“ And *Pharaoh* rose up in the
“ Night, he and all his Servants,
“ and all the *Egyptians*; and there
“ was a great Cry in *Egypt*; for
“ there was not a House where
“ there was not one dead*.

“ This Day shall be unto you
“ for a Memorial; and you shall
“ keep it a Feast to the Lord
“ throughout your Generations:
“ you shall keep it a Feast by an
“ Ordinance for ever†.

The Account of the *Egyptian*
Ceremony, given by *Herodotus*, is
to this Effect.

“ But when the *Egyptians* meet
“ at *Sais* to sacrifice on a certain
“ Night, they all light up many
“ Lamps round about their Houses,
“ in the open Air. The Lamps
“ are

* *Exod.* xii. 29, 30.

† *Exod.* xii. 14.

“ are Vessels filled with Salt and
 “ Oyl, there stands a Wilk on the
 “ Surface that burns all Night.
 “ This Feast is called the Burning
 “ of Lamps. The *Egyptians*, who
 “ come not to this General Assem-
 “ bly, observe however the Night
 “ of the Sacrifice, and all light up
 “ Lamps. So that the Illumination
 “ is not in *Sais* only, but in all
 “ *Egypt*. A sacred Reason is given
 “ for the Light and Honour attri-
 “ buted to this Night.*

If any Memorial were instituted
 on the *Egyptian* Side, it could not
 be devised better than this, to re-
 mind them of the Plague of three
 Days Darkness, and of the Cry
 when all *Egypt* rose by Night upon
 the Slaughter of the First Born;
 nor better contrived to prevent the
 Return

* *Herod. Euterpe*, c. 62. The general As-
 sembly was said to be held in Honour of
Minerva, c. 59.

Return of such another Stroke, as far as human Means could be effectual.

Had the Historian informed us that this solemn Sacrifice and Illumination was observed about the *Æquinox* of Spring, it would greatly favour a Conjecture, that it was instituted on the Part of *Egypt*, as the Passover was on the Part of *Israel*, for one and the same Transaction, to be a Memorial for ever; and a sacred Reason for it might very well be assigned; but the Author on some other Occasions, speaking of sacred Reasons, says, he is not at Liberty to make them publick.

The Christian Churches do not keep the Passover with the *Jews*, on the 14th Day of the Moon. Christ, *our Passover*, who was slain for us, (1 *Corinth.* 5, 7,) rose again on the third Day, being the first Day of the Week, now called *Sunday*,

day, and *Easter* is observed in Memory, not of his Death, but of his Resurrection from the Dead. *Easter* Day is therefore always on a *Sunday*; and on the *Sunday* next after the full Moon which happens * upon, or immediately follows the Spring *Æquinox*. † If that full Moon falls upon a *Sunday*, then *Easter* Day is upon the *Sunday* following.

Hence the *Paschal* Limits are found to be within thirty-five Days, from the 22d of *March* to the 25th of *April*, both inclusive. For the full Moon falling on the 21st of *March*, being *Saturday*, *Easter* will be

* The Word *upon* was not in the Rule of the Book of Common Prayer, but was plainly understood; otherwise *Easter* could not fall upon the 22d of *March*, which by the old Table it might do.

† The Passover was slain on the 14th Day, that is on the full Moon, and on that Day *Christ* suffered; the Feast of his Resurrection cannot therefore be celebrated on that Day which was the Day of his Death, but is transferred to the *Sunday* following.

be on the 22d, and this is the earliest it can fall. But if the full Moon happens on *Saturday* the 20th of *March*, a Day before the *Æquinox*, that Moon cannot be *Paschal*; and the first full Moon after the *Æquinox* will fall thirty Days after, both inclusive, that is on *Sunday* the 18th of *April*; the Feast is therefore translated to *April* the 25th, the *Sunday* following, and this is the latest that *Easter* can fall.

The Limits of the *Paschal* full Moons are likewise found to be within twenty-nine Days, from the 21st of *March* to the 18th of *April*, both inclusive. And within those twenty-nine Days all the Golden Numbers must have their proper Places.

The Places of those Numbers shewing the full Moons in the Calendar, may be determined for any Century required, by adding 13 to
D their

their Places, shewing the new Moons as found above.

The new Moons in the Year 1600 had descended 7 Places, which with 13 make 20. Therefore to find the Place of any Golden Number, shewing the *Paschal* full Moon in any Century required, the Rule is this.

To the constant Number 20, add the Character of that Century, that is, add the Number in the fifth Column of the first General Table corresponding to that Century, and that Sum reckoned downward from the Day of the Month to which the given Golden Number is prefixed in the old Calendar, will shew the Day to which the same Golden Number is to be prefixed for the full Moon in the Century or Centuries to which that Character belongs. But this Rule admits an Exception, which shall be explained hereafter.

Hence

Hence a General Table may be formed, exhibiting the Places of the Golden Numbers in every Century throughout the great Period of 6900 Years, whence *Easter* may be found.

The Table II. consists of thirty two Columns. In the first are the Days of the Month, and in the second the *Sunday* Letters for so much of the Calendar as is necessary to find *Easter*, that is, from the 21st of *March* to the 18th of *April*, being twenty nine Days, within which Limits the *Paschal* full Moons are all included.

Over the other thirty Columns there is a Range of Figures from 0 to 29, in the Nature of *Epacts*, one Figure over each Column ; and again above that Figure are written the Century or Centuries of which it is the Character.

In the Body of each Column the Golden Numbers are disposed in the

Order proper to that Character, and to those Centuries, which are at the Head of it.

It is observable that in the two lowest Ranges of the Table, corresponding to the 17th and 18th of *April*, the Figures are more pressed and crowded together than they are in the upper Part of it; and these Figures come within the Exception to the above Rule.

The Reason of that Crowd and Pressure may appear from these Considerations. All the Golden Numbers are to have Place in every Column; and, if there were room for it, should descend one Step in each successively through thirty Columns, answering to the Number of *Epaets*. But the Limits of the *Paschal* Moons being within twenty nine Days, when any Golden Number has descended those twenty nine Days, it cannot descend any further, because
it

it would then fall beyond the Limits, and be excluded below ; when, perhaps, by the above Rule, it cannot reach the upper Limit of the next Column, the Consequence is, that it must continue at the lowest Limit in the next Column ; and, by staying there, it will affect the Number immediately above it, and hinder it from descending, as by the Rule it ought to do.

A few Examples will explain both the Rule and the Exception.

Examp. 1st. Let the Place of the Golden Number 3 be sought for the Century commencing A. D. 1600. In the old Calendar the Number 3 stands at the first of *March*, and the Character of the Century required is 0 ; add therefore 20 to *March* the 1st, and the Place of the Golden Number 3 will fall on *March* the 21st, and accordingly it is placed there in the Table. The
Characters

Characters at the Head of the Columns increafing by Unity, this Number 3 will defcend one Step in every fucceeding Column till it reaches the loweft Limit under the Character 28. But in the next Column under the Character 29 it cannot defcend; nor can it take Place above at the upper Limit, becaufe it ftands already in that Place in the firft Column under the Character 0, and fo the Columns under the Characters 0 and 29 would be the fame, that is the Number of the Columns would be 29 only, and not 30, anfwering to the Number of *Epacts*, as it ought to be.

Examp. 2d. Let the Place of the Golden Number 14, be fought in the Column under the Character 28. The Number 14 ftands in the old Calendar at *February* the 28th, to which adding 48, (the Sum of 20 and 28) it will fall on the 17th
of

of *April*. But if the Place of the same Number 14 be sought in the next Column under the Character 29, by the Rule it ought to be at the 18th of *April*; which, however, cannot be, for that Place is already possessed by the Number 3, as was shewn in the first Example; and consequently the Number 14 must continue at the 17th of *April*, where it stood in the preceding Column.

The Use of this Table is to find the Time of *Easter* in any Year required.

P R O B L.

The Golden Number and *Sunday* Letter for any Year being given, to find on what Day *Easter* will fall in that Year?

In the Head of Table II. find the Number of Centuries contained in the Year proposed, and in the Column

Column directly under it, look for the Golden Number given, and in the same Range to the left Hand in the first Column there is written the Day on which the *Paschal* full Moon will fall. If the *Sunday* Letter adjoined to it be not that which is given, look downward for the given Letter, and the Day prefixed to it will be *Easter* Day. But if the given Letter be adjoined to the Day of the *Paschal* Moon, look down till you come to the same Letter again, and the Day in the first Column answering thereto will be *Easter* Day.

Examp. 1st. To find *Easter* Day in the Year 1756?

The Golden Number for that Year, will be 9; and, after *February*, the *Sunday* Letter will be C. In the Column under the Year 1700, (or under its Character 1) find the Number 9, and turning the
Eye

Eye to the left Hand in the same Range you meet *April* the 15th, with the Letter G, then look downwards for the *Sunday* Letter C, which answers to *April* the 18th, and on that Day *Easter* will fall in the Year 1756.

Exempl. 2d. To find *Easter* Day in the Year 4355 ?

The Golden Number will be 5, and the *Sunday* Letter B, for that Year. In the Column under 4300 (or its Character 12) find the Number 5, and in the same Range, conducting the Eye to the left Hand, you meet *April* the 10th, with the Letter B, which, being the *Sunday* Letter for that Year, sheweth the full Moon to fall on *Sunday*; and therefore the Feast of *Easter* must be translated to the *Sunday* following, that is, to the 17th of *April*.

Note,

Note, That in Table II. the two first Columns, containing the Days of the Month and the *Sunday* Letters, are understood to be continued downwards, below the Table, for seven Days more to the 25th of *April*.

A P P E N -

APPENDIX.

CONTAINING

Rules relating to the Calendar.

R. 1. **T**O find the Golden Number for any Year proposed.

To the proposed Year of *Christ* add Unity, divide the Sum by 19, the Remainder is the Golden Number sought ; but if the Remainder is 0, then 19 is the Golden Number for that Year.

R. 2. To find the *Julian* Epact for any Year proposed.

Multiply

Multiply the Golden Number of that Year by 11, and divide the Product by 30, the Remainder is the Epact sought.

R. 3. To find the Number of *Lunar* Anticipations in any Year proposed after the Year 1600.

From the Number of Centuries contained in the proposed Year, subtract 14, and reserving the Remainder, say, as 2500^{years} to 8^d. so is the Remainder to a fourth Number, and the Quotient, neglecting the Fraction, will shew how many Days the Moon has anticipated from the Year 1600.

Examp. How many Days will the Moon anticipate, or fall earlier, in A. D. 6800, than it did in the Year 1600?

The Number of Centuries contained in the Year are 68, from thence subtracting 14, the Remainder is 54, which multiplied by
8,

8, and divided by 25, gives in the Quotient 17, the Number of Days that will be anticipated in A. D. 6800.

R. 4. To find the Difference of Days accrued to any Time from the Year 1600, between the old and new Calendars.

From the Number of Centuries contained in the Year proposed, subtract 15, multiply the Remainder by 3, and divide the Product by 4, the Quotient, without Fractions, will give the Difference sought.

Examp. What is the Difference of Days that will accrue from the Year 1600 to 6800?

From 68, the Number of Centuries, subtract 15, the Remainder is 53, which multiplied by 3, and divided by 4, in the Quotient gives 39, the Difference sought.

But in the Year 1600 there was already a Difference of ten Days ;
therefore

therefore to have the intire Difference between the two Calendars, the Numbers found as above must be increased by 10, which added to 39 in the Example, makes the intire Difference in the Year 6800 to be 49 Days.

R. 5. To find the Descent of the Golden Numbers in the Calendar, or how far in any Century proposed they are to be removed downwards from the Places which they held A. D. 1600.

1st. Find the Difference of Days in that Century by the preceding Rule. 2^{dly}. Find likewise the Number of *Lunar* Anticipations for the same Century by Rule 3^d, subtract the latter from the former, and the Remainder will shew the Descent required.

Examp. For the Century beginning A. D. 6800, the Difference of Days was found to be 39, and the

the Number of *Lunar* Anticipations was found to be 17, which subtracted from 39, leaves 22; shewing that the Golden Numbers are to stand 22 Days lower in the Calendar for the Century beginning A. D. 6800, than they did A. D. 1600.

R. 6th. To find the new Epact for any Year proposed.

To the Descent of the Golden Number in the proposed Year, (found by Rule 5th) add 10, and subtract the Sum from the *Julian* Epact, (Rule 2d) the Remainder is the Epact sought. But the *Julian* Epact, if it be less than that Sum, must be increased by 30, or if Need be, by 60; and the above said Sum deducted from it, leaves the Epact.

Examp. 1st. The Epact for the Year 6800 is thus found.

The *Julian* Epact for that Year will be 18, the Descent of the Golden Number augmented by 10 will

will be 32, which cannot be had out of 18; but the *Julian* Epact increased by 30 will be 48, from whence taking 32, the Remainder 16 is the Epact sought.

Examp. 2d. What will be the Epact for the Year 8300?

The *Julian* Epact for that Year will be 7, the Descent of the Golden Numbers augmented by 10 will be 39, which taken from the *Julian* Epact increased by 60, will leave 28 for the Epact sought.

Note, The Cycle of Epacts is not used in the *English* Calendar; it has, however, been thought proper to insert it in a separate Column at the End of Table II.

R. 7th. To find the Dominical or *Sunday* Letter for any Year required.

1st. Divide the Number of Centuries contained in any given Year by 4. Seek the Remainder in the little

little Table on the left Hand. And in the Cell adjoining thereto, in the larger Table, you have the *Sunday* Letter belonging to the last Centurial Year, with its Number over it.

2. Divide the Number of Years remaining over and above the Number of Centuries by 28, add the Remainder of this Division to the Number found over the Centurial Letter.

3. Seek the Sum in the larger Table, and with it you have the *Sunday* Letter sought for that Year.

0	1 B A	2 G	3 F	4 E
	29	30	31	32
1	5 D C	6 B	7 A	8 G
	33	34	35	36
2	9 F E	10 D	11 C	12 B
	37	38	39	40
3	13 A G	14 F	15 E	16 D
	17 C B	18 A	19 G	20 F
	21 E D	22 C	23 B	24 A
	25 G F	26 E	27 D	28 C

Note, If the Sum exceeds 28, seek it in the upper Eanges under the Letter.

R

Examp.

Examp. 1st. To find the *Sunday* Letter for the Year 1769.

The Number of Centuries contained in this Year is 17, which divided by four Leaves one for the Remainder. In the little Table annexed find 1, and in the Cell adjoining to it in the large Table the *Sunday* Letters are D C, with the Number 5 over them; C then is the *Sunday* Letter for the Year 1700. 2dly, The Years over and above the Number of Centuries are 69, which divided by 28, the Remainder is 13, and adding thereto 5, (the Number found over the Letter C) the Sum is 18, and underneath that Number is A, the *Sunday* Letter for the Year 1769.

Examp. 2d. To find the *Sunday* Letter for the Year 1955?

The Number of Centuries is 19, which divided by 4, the Remainder is 3. In the short Table find 3,
and

and in the Cell adjoining thereto in the large Table the Letters are A G, with the Number 13 over them ; G is therefore the *Sunday* Letter for the Year 1900. 2dly, The Years over and above the Number of Centuries are 55, which divided by 28, the Remainder is 27, adding thereto 13 (the Number found over the Letters A G) the Sum is 40. But this Sum, exceeding 28, is to be sought in the upper Ranges, where it will be found under the Letter B, which is the *Sunday* Letter for the Year 1955.

The inserting a Day in the Leap Year made a second Letter necessary to shew the *Sunday* after the Insertion ; the former Letter serves from the first of *January* to the inserted Day ; and the second serves from thence to the End of the Year.

The

The additional Day was placed by Order of *Julius Cæsar* before the fixth of the Calends of *March*, and was called the *Bissexus*, which gave Name to the Year.

That Order is observed to this Day in the *Roman* Church; and was, in Effect, complied with by the Church of *England* at the Reformation. For in a Leap Year the Day was inserted before the 24th of *February*, which coincides with the fixth of the Calends of *March*. This appears in the old Books of Common Prayer, by a Rule under this Title.

“ The Order how the rest of Holy
 “ Scripture, beside the *Psalter*, is
 “ appointed to be read.

The Rule is this.

“ When the Year of our Lord
 “ may be divided into four even
 “ Parts

“ Parts, which is every fourth Year,
 “ then the *Sunday* Letter leapeth ;
 “ and that Year the Psalms and
 “ Lessons which serve for the 23d
 “ of *February*, shall be read again
 “ the Day following, except it be
 “ *Sunday*, which hath proper Les-
 “ sons of the old Testament ap-
 “ pointed in the Table serving to
 “ that Purpose.

This Rule seems to direct that the
 23d of *February* should be account-
 ed twice in a Leap Year, and con-
 sequently the 25th would be nomi-
 nally the 24th of that Month.
 The Rule however not being clearly
 expressive of that Intention, a Doubt
 arose whether the Festival of St.
Matthias should be observed in a
 Leap Year upon the 24th or 25th
 of *February*.

But, among the Alterations made
 in the Book of Common Prayer at
 the Restoration of King *Charles* the
 second,

second, the Rule above recited was intirely omitted ; and a 29th Day was added in the Calendar at the End of *February*, to which there is not any *Sunday* Letter affixed, but *Lessons* are appointed for the Morning and Evening Services. This is the first Instance in any Calendar, that I have seen, of a 29th Day added to the Month of *February*.

Whence it appears that the former Rule, by the Omission of it, was made void, and the additional Day in a Leap Year taking Place after the End of *February*, all Uncertainty was removed concerning the Day of St. *Matthias*, which is thereby fixed to the 24th of that Month.

Though the sixth of the Calends of *March*, at present, is not accounted twice, yet, from the antient Usage, the Year commonly retains the Name of *Bissextile*.

And

(55)

And if the additional Day had been transferred from *February*, and placed after the End of *December* preceding, the Form of the Year would have been more elegant, and more simple.

The E N D.



Errat. Page 16. Line the 23d.
after 3" insert 3'''.

And if the additional Day had
been transferred from February, and
placed after the end of January,
making the first of the Year
would have been more elegant, and
more simple.

The E. N. D.

Page 10 Line 23d.
after "insert."

Table I.

	Moon Anti: cipat	Differ of Days	Des: cent of G:N	Differ of Epacts		Moon Anti: cipat	Differ of Days	Des: cent of G:N	Differ of Epacts
BA 1600	0	0	0	10	BA 5200	¹² •	27	15	25
C 1700		1	1	11	C 5300		28	16	26
E 1800	¹ •	2	1	11	E 5400	¹³ •	29	17	27
G 1900		3	2	12	G 5500		30	17	27
BA 2000		3	2	12	BA 5600		30	17	27
C 2100	² •	4	2	12	C 5700		31	18	28
E 2200		5	3	13	E 5800	¹⁴ •	32	18	28
G 2300		6	4	14	G 5900		33	19	29
BA 2400	³ •	6	3	13	BA 6000		33	19	29
C 2500		7	4	14	C 6100	¹⁵ •	34	19	29
E 2600		8	5	15	E 6200		35	20	0
G 2700	⁴ •	9	5	15	G 6300		36	21	1
BA 2800		9	5	15	BA 6400	¹⁶ •	36	20	0
C 2900		10	6	16	C 6500		37	21	1
E 3000	⁵ •	11	6	16	E 6600		38	22	2
G 3100		12	7	17	G 6700		39	23	3
BA 3200		12	7	17	BA 6800	¹⁷ •	39	22	2
C 3300	⁶ •	13	7	17	C 6900		40	23	3
E 3400		14	8	18	E 7000		41	24	4
G 3500		15	9	19	G 7100	¹⁸ •	42	24	4
BA 3600	⁷ •	15	8	18	BA 7200		42	24	4
C 3700		16	9	19	C 7300		43	25	5
E 3800		17	10	20	E 7400	¹⁹ •	44	25	5
G 3900	⁸ •	18	10	20	G 7500		45	26	6
BA 4000		18	10	20	BA 7600		45	26	6
C 4100		19	11	21	C 7700	²⁰ •	46	26	6
E 4200		20	12	22	E 7800		47	27	7
G 4300	⁹ •	21	12	22	G 7900		48	28	8
BA 4400		21	12	22	BA 8000	²¹ •	48	27	7
C 4500		22	13	23	C 8100		49	28	8
E 4600	¹⁰ •	23	13	23	E 8200		50	29	9
G 4700		24	14	24	G 8300	²² •	51	29	9
BA 4800		24	14	24	BA 8400		51	29	9
C 4900	¹¹ •	25	14	24	C 8500		52	0	10
E 5000		26	15	25	&c.				
G 5100		27	16	26					

A General Table to find Easter ac

Paschal full Moons		2100240025002800330036003700400044004900															
		180020002700300032003900430046004800															
		160017001900220023002600290031003400350038004100420045004700															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
March	21	C	3	14		6	17		9		1	12		4	15		7
	22	D		3	14		6	17		9		1	12		4	15	
	23	E	11		3	14		6	17		9		1	12		4	15
	24	F		11		3	14		6	17		9		1	12		4
	25	G	19		11		3	14		6	17		9		1	12	
	26	A	8	19		11		3	14		6	17		9		1	12
	27	B		8	19		11		3	14		6	17		9		1
	28	C	16		8	19		11		3	14		6	17		9	
	29	D	5	16		8	19		11		3	14		6	17		9
	30	E		5	16		8	19		11		3	14		6	17	
31	F	13		5	16		8	19		11		3	14		6	17	
April	1	G	2	13		5	16		8	19		11		3	14		6
	2	A		2	13		5	16		8	19		11		3	14	
	3	B	10		2	13		5	16		8	19		11		3	14
	4	C		10		2	13		5	16		8	19		11		3
	5	D	18		10		2	13		5	16		8	19		11	
	6	E	7	18		10		2	13		5	16		8	19		11
	7	F		7	18		10		2	13		5	16		8	19	
	8	G	15		7	18		10		2	13		5	16		8	19
	9	A	4	15		7	18		10		2	13		5	16		8
	10	B		4	15		7	18		10		2	13		5	16	
	11	C	12		4	15		7	18		10		2	13		5	16
	12	D	1	12		4	15		7	18		10		2	13		5
	13	E		1	12		4	15		7	18		10		2	13	
	14	F	9		1	12		4	15		7	18		10		2	13
	15	G		9		1	12		4	15		7	18		10		2
	16	A	17		9		1	12		4	15		7	18		10	
	17	B	6	17	17	9		1	12	12	4	15	15	7	18	18	10
	18	C	14	6	6	17	9	9	1	1	12	4	4	15	7	7	18

[illegible]